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PHOTOGRAPHIC INTERPRETATION REPORT

ELECTRIC POWER AT SELECTED AMM AND SPACE INSTALLATIONS USSR

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OCTOBER 1965
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PHOTOGRAPHIC INTERPRETATION REPORT

ELECTRIC POWER AT SELECTED AMM AND SPACE INSTALLATIONS USSR

OCTOBER 1965

NATIONAL PHOTOGRAPHIC INTERPRETATION CENTER

INTRODUCTION

The 17 sites considered in this report include electronic installations at Sary-Shagan Antimissile Test Center (SSATC) and at operational sites near Leningrad, Moscow, Olenegorsk, and Angarsk (Figure 1). In the preparation of analyses of electric power available at the 17 sites, the best of the [redacted] period was studied and compared with previous studies, but the latest mission does not necessarily provide the quality requisite for identification of electrical equipment and installations. Only under favorable conditions is it possible to obtain photography that permits identification of the locations and shadow configurations of powerline supports, or the transformers and switching equipment at substations. Optimum conditions are required to permit estimating power available in megavolt-amperes (MVA), because such estimates require the ability to measure transformers to a degree of accuracy of plus or minus 6 inches. Mission [redacted] provided excellent photography for detailed mensuration at Site 13, SSATC, and at the dual HEN HOUSE installation at Angarsk.

Determination of powerline kilovoltages is based on a number of factors. Fortunately, USSR high-tension electric power technology is standardized to a large extent, providing data that permit a high degree of reliability in photo interpretation if photographic quality permits identification of enough elements. Evaluations presented in this report are based on one or more of the following criteria:

1. The length of conductor spans, based on distances between powerline supports;
2. Configurations of supports and occasionally mensuration of crossarms (usually observed from shadows);
3. Layouts and arrangements of electrical equipment, with some mensuration, at substations associated with and serving the installations; and
4. Sizes and types of transformers.

FIGURE 1. LOCATION MAP.

LENINGRAD AREA AMM/SAM LAUNCH COMPLEXES

A pattern is evident in the analysis of the electric power facilities and source of supply serving the three AMM/SAM launch complexes in the Leningrad area. Each complex has a secured substation which is the terminus of a 110-kilovolt (kv) powerline tied into the Leningrad power grid of the Soviet Unified Power System, and each substation contains 2 stepdown transformers.

NORTHWEST AMM/SAM LAUNCH COMPLEX

The Leningrad Northwest AMM/SAM Launch Complex is located at 60-27-00N29-44-10E (Figure 2), 37 nautical miles (nm) northwest of Leningrad. Incoming power is supplied by a 1-circuit (or possibly a 2-circuit) 3-phase 110-kv powerline of the Leningrad power grid via a small switching and transformer substation southeast of the complex, near SAM Site C33A-2. The substation appears to have equipment installed to handle one in-and-out circuit. Two parallel powerlines of the Leningrad power grid bypass southwest of the complex, and the complex is probably electrically independent of them.

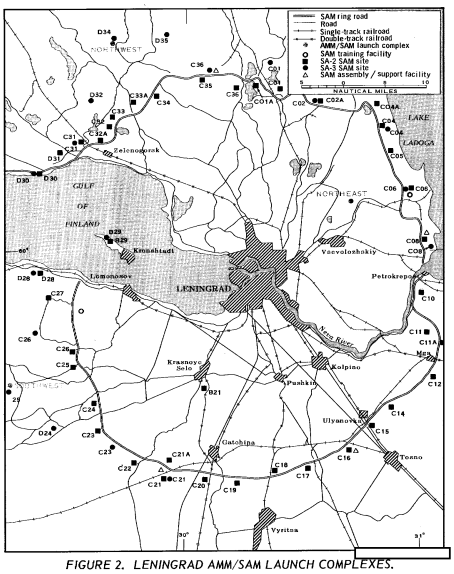

FIGURE 2. LENINGRAD AMM/SAM LAUNCH COMPLEXES.

Terminus of the incoming powerline at the complex is a secured transformer substation approximately 190 feet square. It is located 1,800 feet southeast of the barracks area, and southwest of the complex access road (Figure 3). The substation has a small control building which probably contains some provision for housing low-voltage switching equipment. The substation has 3 probable switching positions and two 3-phase, stepdown transformers, each of which is estimated to have a capacity of 70 or more MVA.

Although in a previous report 1/ a probable powerplant had been identified in the support area, recent better quality photography indicates that the building is probably a steam plant, and no powerplant can be identified.

NORTHEAST AMM/SAM LAUNCH COMPLEX

The Leningrad Northeast AMM/SAM Launch Complex is located at 60-05-20N 30-44-00E, 16 nm northeast of Leningrad (Figure 2). Incoming power is probably supplied by a 110-kv powerline of the Leningrad power grid.

At the complex there is a secured transformer substation, approximately 210 by 150 feet, located 1,200 feet southeast of the support area, at the intersection of the access road and the Leningrad-Rakhya highway (Figure 4). Within the security fence, there is a small control building that probably contains low-voltage switching equipment. The substation is the terminus of a single-circuit, 3-phase, 110-kv powerline, it possibly has 3 switching positions, and it contains 2, probably 3-phase, stepdown transformers. The small scale of available photography precludes an estimate of their capacities.

Although a probable powerplant had been identified in the support area in a previous report, 1/ recent photography indicates that the building is probably a steam plant, and no powerplant can be identified.

SOUTHWEST AMM/SAM LAUNCH COMPLEX

The Leningrad Southwest AMM/SAM Launch Complex is located at 59-43-00N 29-18-30E, 33 nm southwest of Leningrad. Incoming power is supplied by a probably single-circuit 3-phase 110-kv powerline of the Leningrad power grid via a small switching and transformer substation just east of SAM Site C27-2. The substation appears to have equipment installed to handle one in-and-out circuit.

Terminus of the incoming powerline is a secured transformer substation approximately 160 by 170 feet in area located immediately east of the barracks area and on the north side of the complex access road (Figure 5). The substation has a small control building which probably contains some provision for housing low-voltage switching equipment. The substation has 3 probable switching positions and two 3-phase stepdown transformers, but an estimate of their MVA capacities is not possible on the basis of available photography.

DOG HOUSE

The suspect AMM phased-array radar (DOG HOUSE) installation near Naro-Fominsk is 35.7 nm west-southwest of Moscow, at 55-29-50N 36-40-10E (Figure 6). It will receive power from a large transformer and switching substation, 11,700 feet southwest of Operational Area A (Figure 7), which apparently will be a major substation on the 220-kv grid serving Moscow. Electrical equipment was still in the process of being installed in [redacted] (Figure 8). At that time, supports for four 220-kv powerlines from the southwest had been installed to the 220-kv switching yard of the substation. Whether conductors had been strung cannot be determined. Of these, the northernmost powerline (item 2, Figure 8) is supported by standard USSR design 2-circuit 3-phase steel or aluminum lattice powerline supports, but switching and circuit-breaker equipment had been provided in the switching yard to receive only one of these circuits. The supports (items b-d) for each of the remaining three 220-kv powerlines appear to be designed to carry only 2 conductors apiece; consequently, two 3-phase circuits have to be carried on 3 lines of powerline supports. Both circuits are tied into

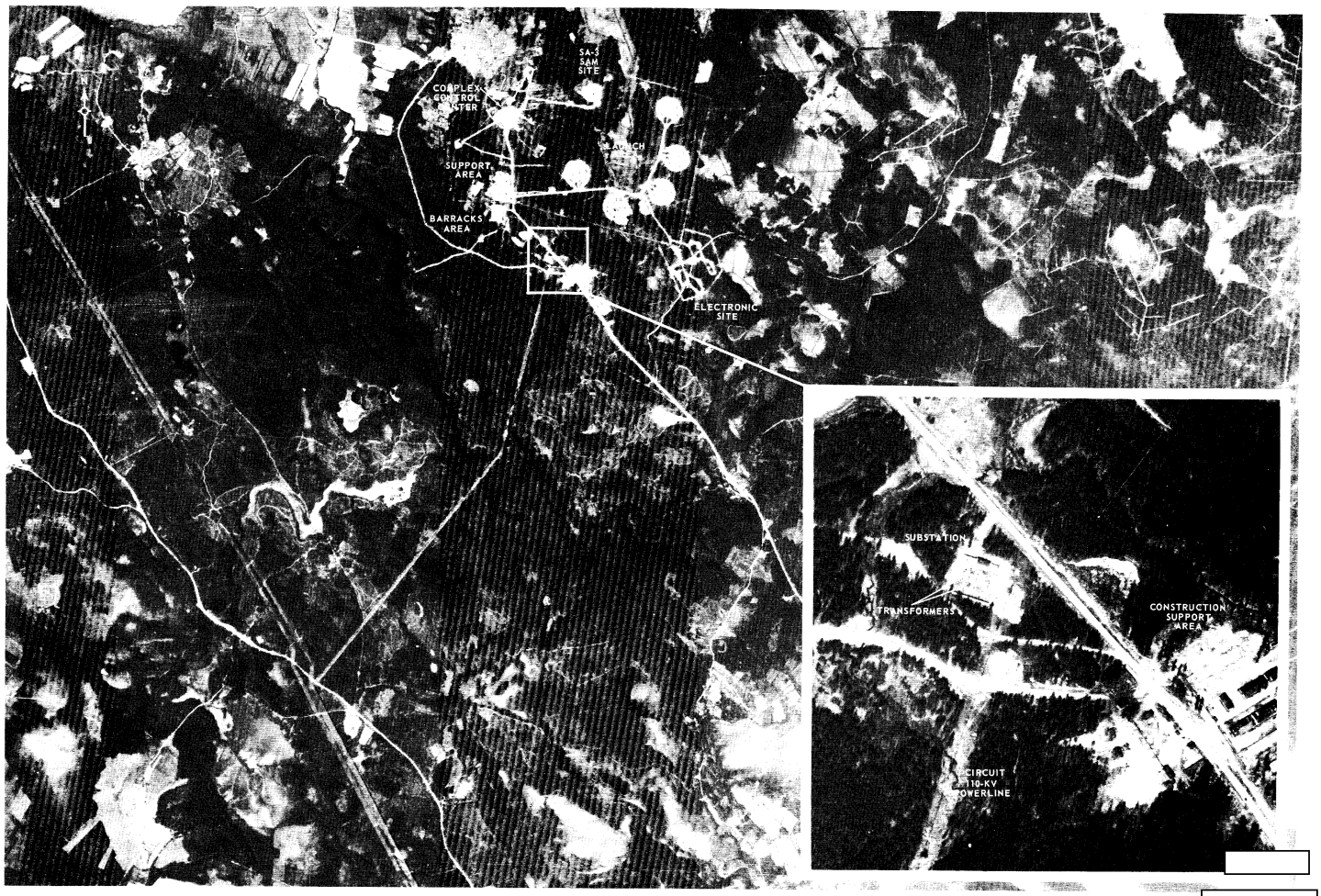

FIGURE 3. LENINGRAD AMM/SAM LAUNCH COMPLEX NORTHWEST.

switching and circuit-breaker equipment in the switching yard.

On photography there was no evidence of the installation of 220-kv stepdown transformers; however, the equipment already installed indicated that at least 3 banks of 3 single-phase, stepdown 220/35/10- or 6-kv transformers probably were planned. The south end of the control building could contain as many as 90 low-voltage switching positions.

A small separately secured switching yard was located in the southeast corner of the substation, and photography revealed switching and circuit-breaker equipment for 4 incoming 35-kv circuits and for 2 internal circuits. No stepdown transformers were visible, but it is possible that the control building may house 35/10- or 6-kv transformers as well as low-voltage switching equipment.

TRIADS AT FOUR MOSCOW SA-1 SAM SITES

The possible AMM electronic facilities (triads) at 4 SA-1 SAM sites in the Moscow area (Figure 6) are estimated to be supplied electric power at 10 or 6 kv. Power at these voltages can be supported on ordinary wooden, metal, or reinforced concrete poles such as are also used for telephone and telegraph circuits. They usually can be identified only on photography of adequate scale, taken under optimum conditions. Soviet equipment for 10- and 6-kv powerlines is almost identical, therefore exact voltage cannot be determined from photography alone. At none of the sites can any higher voltage supply be identified on available photography, and it is possible that the higher voltages of the Moscow grid (110-, 220-, and 500-kv) are kept isolated from the triads to avoid electrical interference with electronic equipment at the sites. Each of the SA-1 sites is in the vicinity of a substation on a 110-kv powerline of the Moscow power grid of the Soviet Unified Power System.

MOSCOW SAM SITE E05-1

Moscow SAM Site E05-1 is at 56-14-35N 38-35-05E. At the northeast corner of the launch area, within the triple fence that surrounds the area containing the two triads under construction, there are several

FIGURE 4. LENINGRAD AMM/SAM LAUNCH COMPLEX NORTHEAST.

FIGURE 5. LENINGRAD AMM/SAM LAUNCH COMPLEX SOUTHWEST.

buildings north of the largest building in Triad 1. One of these small buildings is separately secured and is a suspect substation that may house control and low-voltage switching equipment (Figure 9). The quality of available photography precludes identification of open-air transformers. No traces for high-tension powerlines serving this installation can be seen, indicating that only low-voltage power serves the site.

Incoming power is probably supplied by a 110-kv powerline of the Moscow power grid and stepped down at a nearby substation located at approximately 56-13N 38-30E. A trace generally parallels the highway between Zagorsk and Orekhovo-Zuyevo, and spacing of the supports is typical of 110-kv powerlines.

MOSCOW SAM SITE E15-1

25X1

25X1

This site [redacted] is located at 55-09-50N 38-22-15E. In the northeast corner of Triad 1 there is a small secured substation with a building that probably houses control and low-voltage switching equipment, and there is switching equipment located northeast of the building (Figure 10). The electric power at the SAM site is most likely similar to that at SAM Site E05-1. A possible 110-kv powerline trace of the Moscow power grid roughly parallels the Voskresensk-Malino highway, which is to the north of the SAM site. A small suspect substation on that line is at approximately 55-11N 38-19E, about 3 nm north of the SAM site and is probably tied into the substation in the triad area.

MOSCOW SAM SITE E24-1

This site [redacted] is at 55-21-04N 36-29-27E. A secured substation is located adjacent to the southwestern entrance to the SAM site (Figure 11). No traces for high-tension powerlines serving the SAM site can be seen, indicating that only low-voltage power serves the site. Power probably is supplied at 10 or 6 kv from a suspect substation on a probable 110-kv powerline of the Moscow power grid. That suspect substation is about 2 1/2 nm east-northeast of the SAM site.

MOSCOW SAM SITE E33-1

This site [redacted] is at 56-20-00N 36-48-27E. A suspect substation may be located near the west entrance to the secured triads. Power is probably supplied to this facility at 10 or 6 kv from a substation on a 110-kv powerline. The substation is at 56-19N 36-45E, at the southeastern limits of Klin and approximately 2 1/2 nm southwest of the triads.

25X1

SARY-SHAGAN INSTALLATIONS

The Balkhash power grid (Figure 13), which serves Sary-Shagan Antimissile Test Center west of Lake Balkhash, was first studied from [redacted] On that photography, a 110-kv powerline was identified that tied the large transformer substation near the Main Housing Complex to the Balkhash grid. Also at that time, a single-circuit 3-phase 35-kv powerline connected Balkhash to Gulshad, northeast of Sary-Shagan. Other powerlines served mining and ore-processing installations north of Balkhash, at Kounradskiy and vicinity.

25X1

[redacted] the thermal powerplant in Balkhash was expanded by the addition of a new section and a second stack. This powerplant is the principal source of electricity used at SSATC. Small local generating plants possibly exist at some installations within the Test Center, but they apparently do not provide power for the installations studied for this report. These installations include 4 triads, 4 dual HEN HOUSEs, a single HEN HOUSE, and 2 HEN ROOSTs.

TRIAD, INSTRUMENTATION SITE 2

Instrumentation Site 2, at 45-47-40N 73-35-00E, is the southernmost installation in the support base at SSATC. [redacted] revealed a small secured transformer substation approximately 2 nm north of Site 2, on the west side of the site access road. At that time it received power from the substation at the main housing complex over a single powerline (Figure 14).

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Photography of [redacted] showed a second power-

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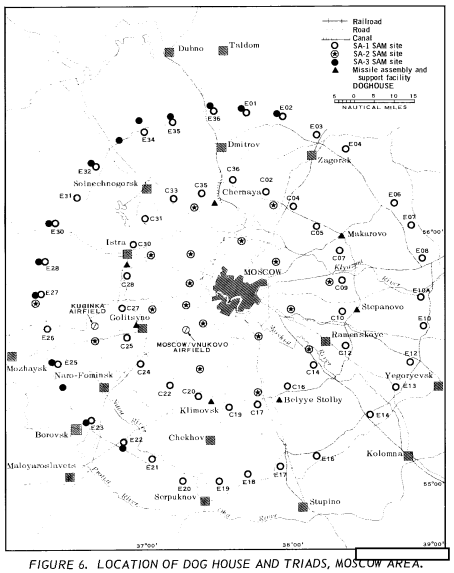

FIGURE 6. LOCATION OF DOG HOUSE AND TRIADS, MOSCOW AREA.

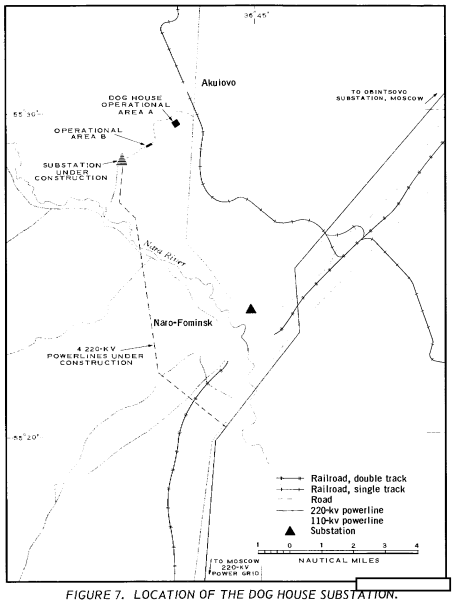

FIGURE 7. LOCATION OF THE DOG HOUSE SUBSTATION.

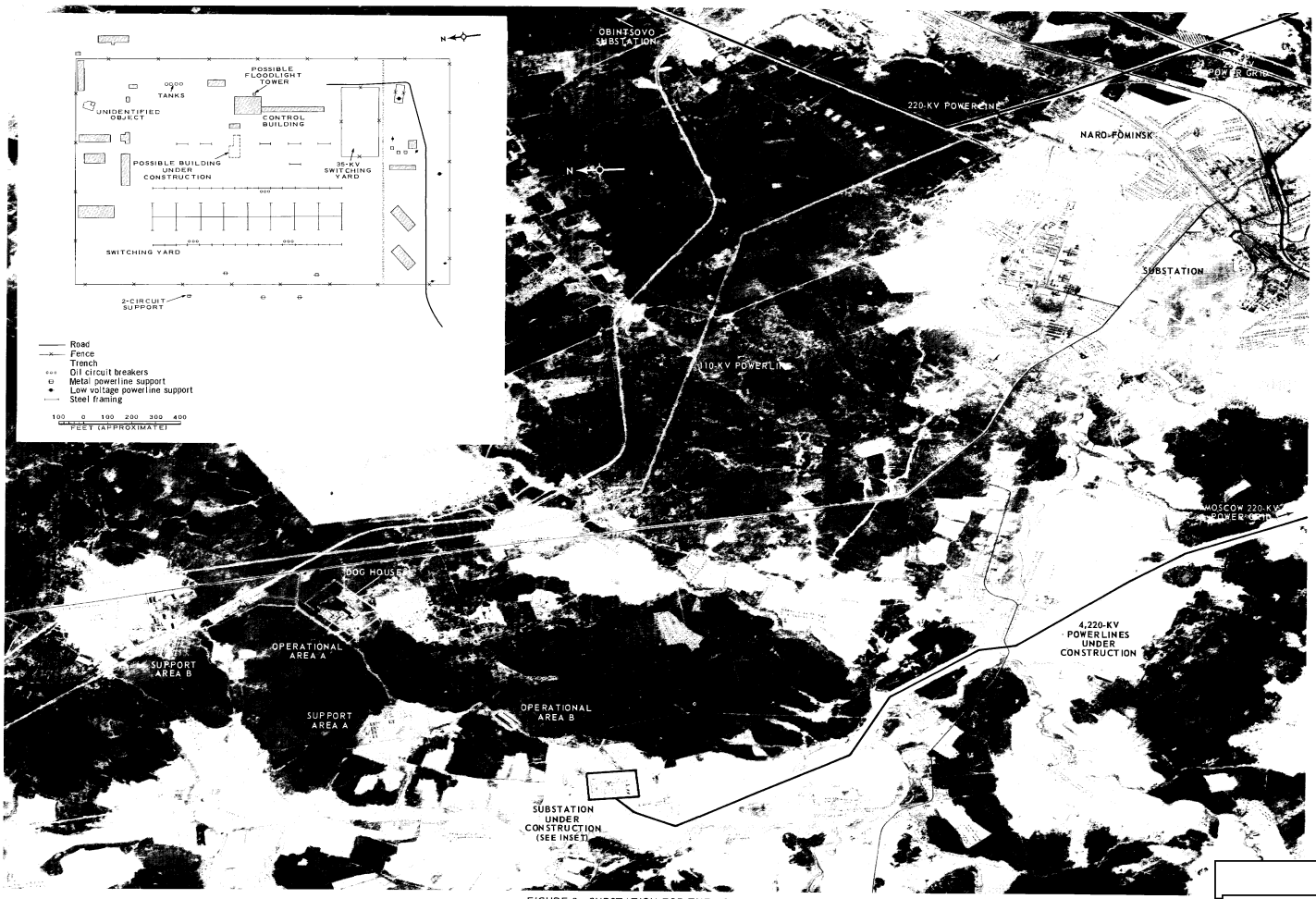

FIGURE 8. SUBSTATION FOR THE DOG HOUSE.

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line generally paralleling the earlier one. Each is probably a single-circuit, 3-phase, 35-kv powerline and is tied into one of the two 35-kv stepdown transformers within the secured area. The small scale of available photography precludes estimating the MVA capacity of the transformers.

In 1960, cable scars were apparent between the substation and both Instrumentation Site 2 and the area where HEN ROOST antennas were under construction. It is estimated that the voltage carried by these buried cables is 10 or 6 kv because higher voltage cables are seldom buried.

Recent photography reveals that the buried cable to the Operations Area, of which the triad is a part, is possibly tied into a small possible control and low-voltage switching building immediately east of the L-shaped building.

TRIAD, LAUNCH COMPLEX B

Two 110-kv powerlines are generally parallel to the road between the Main Support Base and Launch Complex B. The 2 single-circuit 3-phase powerlines are tied into a substation with 2 transformers. It is located at 45-58N 72-32E, in the middle of Launch Complex B support area (Figure 15). A suspect low-voltage powerline that parallels the road between the support area and the launch area apparently has been in service for some time. It is estimated to be a 10- or 6-kv powerline, both because the poles are set for short spans and because their shadows give no evidence of crossarms such as are indicated for support of a 35-kv or higher voltage powerline.

During the period in which the triad was under construction in the launch area, a single-circuit, 3-phase, 110-kv powerline was also under construction to a suspect substation in the southeast corner of the triad area. The completion of this powerline or of the substation cannot be confirmed from photography available through [redacted] nor can an estimate of available capacity be given in MVA.

25X1

TRIAD, INSTRUMENTATION SITE 10

A small secured probable transformer substation is located at 46-56N 72-31E, in the support area of Instrumentation Site 10 (Figure 16). The substation is the probable terminus of two single-circuit 3-phase 110-kv powerlines which are tied into a substation in the headquarters and administration area of Launch Complex A.

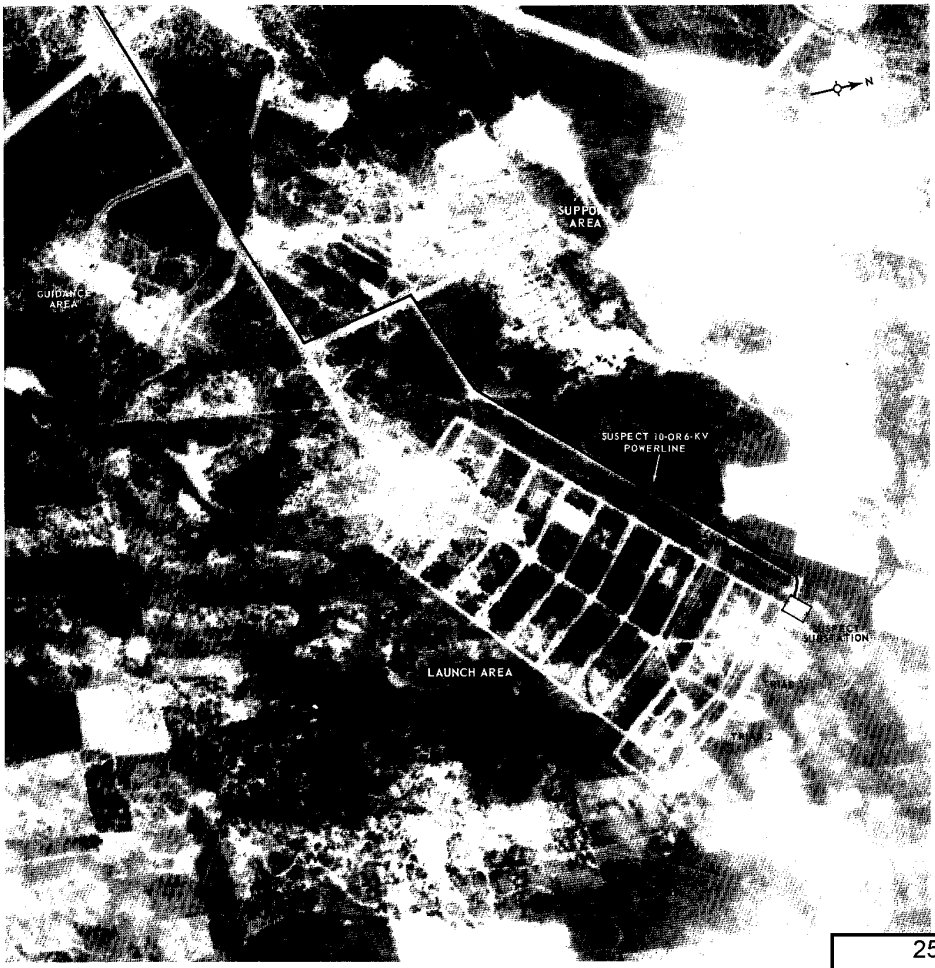

FIGURE 9. MOSCOW SAM SITE E05-1.

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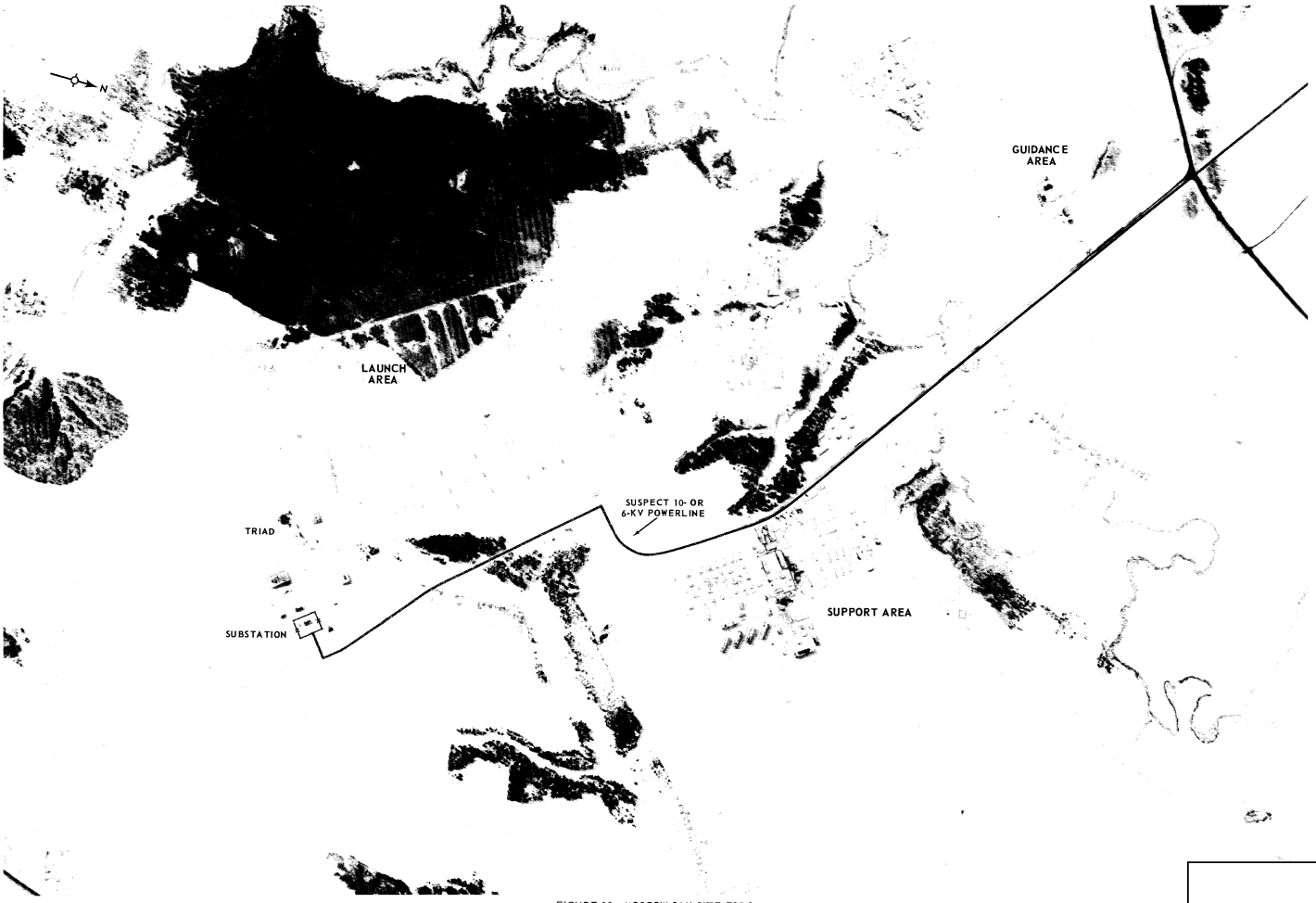

FIGURE 10. MOSCOW SAM SITE E15-1.

FIGURE 11. MOSCOW SAM SITE E24-1.

TRIAD AND DUAL HEN HOUSES, SITE 13

25X1 Two adjacent substations have been identified at Site 13, northwest of the triad and the dual HEN HOUSEs (Figures 17 and 18). The small secured transformer substation at 47-37N 74-31E is [redacted] It appears to be of standard Soviet design and is the terminus of a tap-off single-circuit 3-phase 35-kv powerline. The powerline is tied into the Balkhash-Gulshad 35-kv powerline by drop line connections (Figure 19).

25X1 A second, much larger, transformer substation was in the final stages of construction in [redacted] approximately 25X1 300 feet east of the smaller substation. Two buildings had been completed and support framing for 6 switching positions and probably 2 buses had been installed by [redacted] 25X1 [redacted] Provision was being made at that time for the installation of 2 probably 110/10- or 6-kv transformers, and one of these had been installed by [redacted] 25X1 Some 35-kv switching equipment was also being installed.

25X1 By [redacted] a 2-circuit 3-phase 110-kv tie powerline had been completed between the larger substation and one of the 2 circuits of the powerline between Balkhash and the Main Support Base, and construction had been started on another 110-kv powerline generally parallel to it (Figures 17 and 20). Some support towers had been installed and concrete footings for others had been poured. One support was lying on the ground near the substation.

25X1 In [redacted] it appeared most likely that one of the two circuits between Balkhash and Sary-Shagan had been, or would be, cut to detour power through the switching facilities at the larger substation at Site 13 (Figures 20 and 21). The smaller substation probably would be either abandoned or disconnected from the Balkhash-Gulshad powerline and would receive its stepped down power from the 110-kv transformers in the larger substation. Low-voltage power for the HEN HOUSEs and triad is, or probably will be, transmitted by buried cable.

SINGLE HEN HOUSE

The single HEN HOUSE antenna at SSATC is served by a secured on-site transformer substation located on the east side of the coastal road between the Main Housing Complex and Instrumentation Site 2 (Figures 22 and 23). The substation may be the terminus of a single-circuit 3-phase, probably 35-kv powerline from the 35-kv switching yard of the main substation near the Main Housing Complex. Photography through [redacted] permits the identification of only one possible transformer, and further electrical details cannot be ascertained.

TWO HEN ROOSTS

The 2 HEN ROOST antennas south of the single HEN HOUSE installation apparently receive power through a secured probable substation at the north end of the support

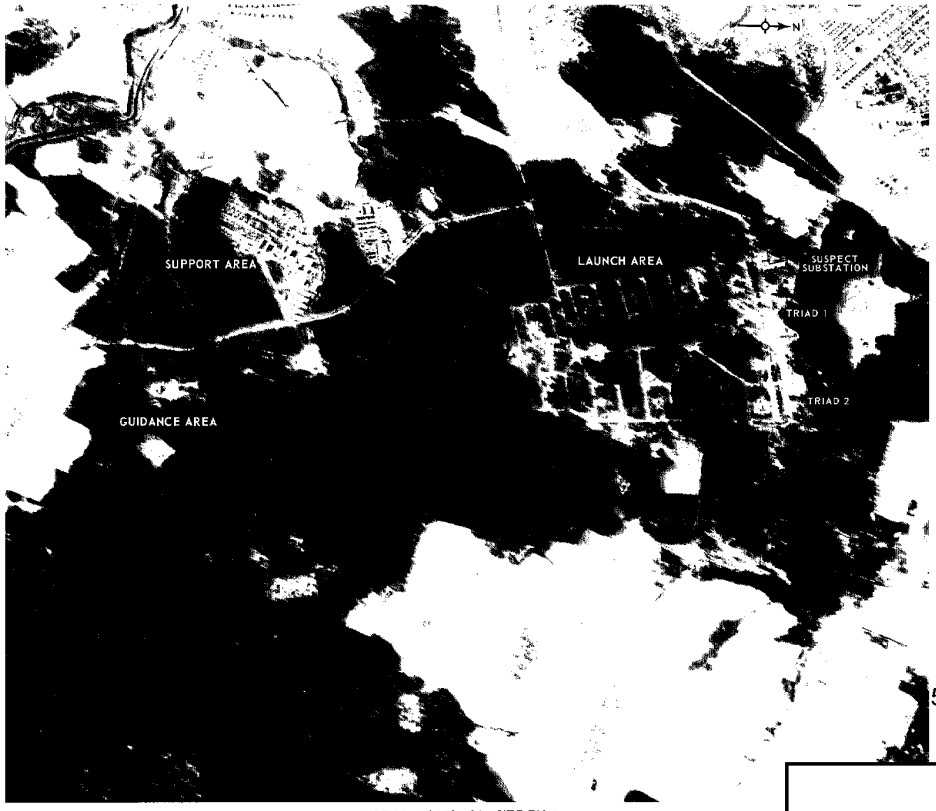

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FIGURE 12. MOSCOW SAM SITE E33-1.

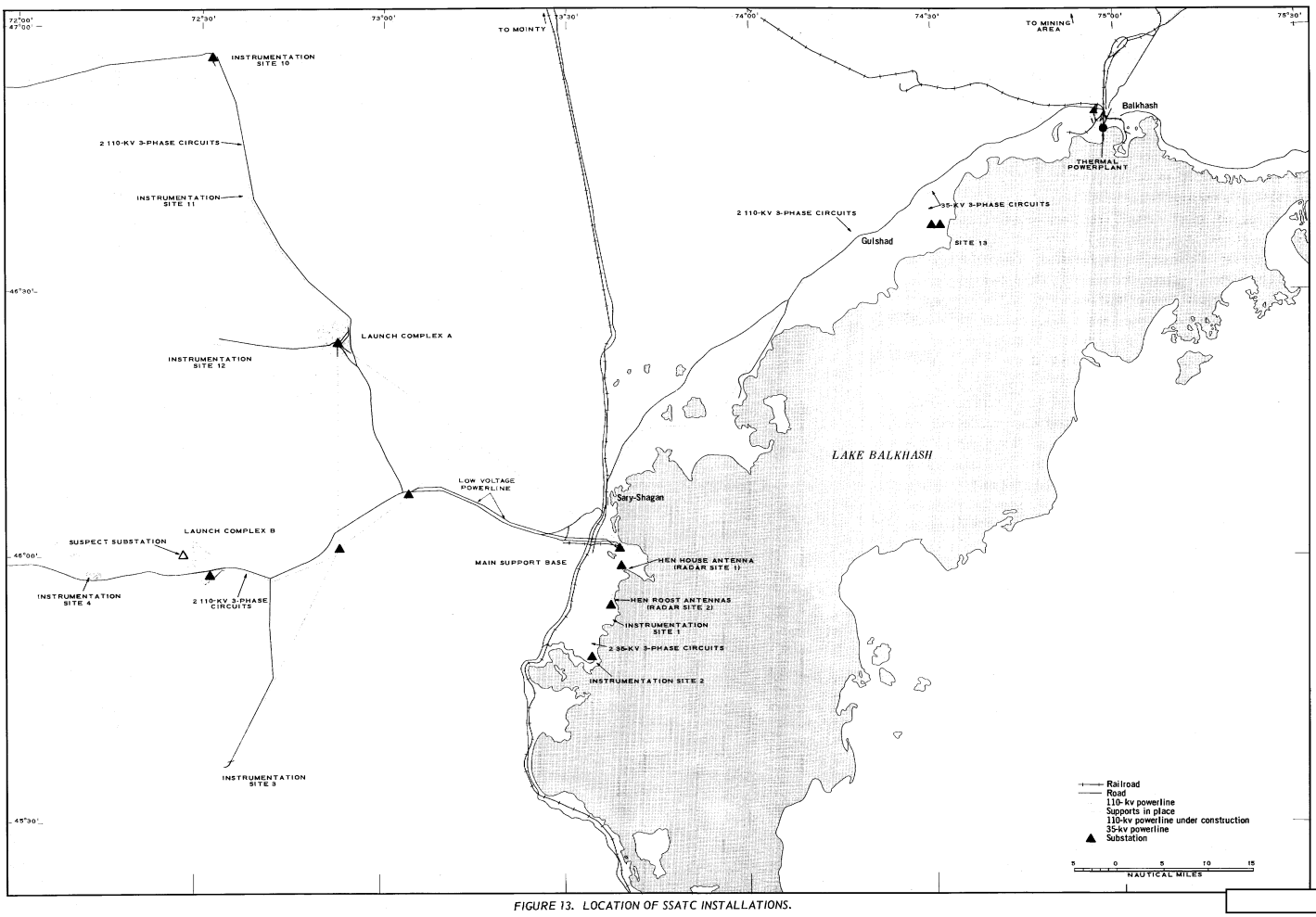

FIGURE 13. LOCATION OF SSATC INSTALLATIONS.

area for the southern HEN ROOST. Whether one or two 35-kv circuits have been tied into this substation cannot be ascertained from the photography. One probable transformer can be identified.

DEPLOYED DUAL HEN HOUSES

The dual HEN HOUSEs under construction at Olenegorsk and Angarsk in spring 1965 will receive power from 110-kv powerlines that serve on-site transformer substations. At each site, apparently there will be 2 incoming single-circuit powerlines and at least 2 stepdown transformers. Provision is being made to keep the incoming circuits separated at both sites. The power is actually received from 2 directions, thus helping to insure that a continuous power supply will be available even if an outage should affect one incoming circuit.

OLENEGORSK DUAL HEN HOUSE

The dual HEN HOUSE under construction in 1965 at 68-07N 33-55E, 13 nm east of Olenegorsk (Figures 24-26), received power from the Murmansk power grid. A major switching and transformer substation of the grid is located near the Olenegorsk railroad yards of the north-south electrified railroad which serves Murmansk and the Kola pensinula. Power is received at the dual HEN HOUSE through an on-site secured transformer and switching substation which covers an area of approximately 460 by 240 feet, located at the southeastern end of the support area.

Incoming powerlines from the grid are 2 single-circuit 3-phase 110-kv powerlines whose conductors are supported mainly by timber pi-portal supports with timber A-frame supports at angular changes of direction. Whether both circuits were in service could not be determined from photography available in spring, 1965.

Power from these 2 circuits could be switched out of the substation through an outgoing single-circuit powerline that runs in an easterly direction to Alluaiv. This powerline parallels a 110-kv single-circuit powerline that ties a substation of the [redacted] also to Alluaiv. A probably single-circuit powerline can be traced further east between Alluaiv and Lovozero.

The unusual crisscrossing of powerlines of the same voltage (110-kv) possibly indicates the following sequence

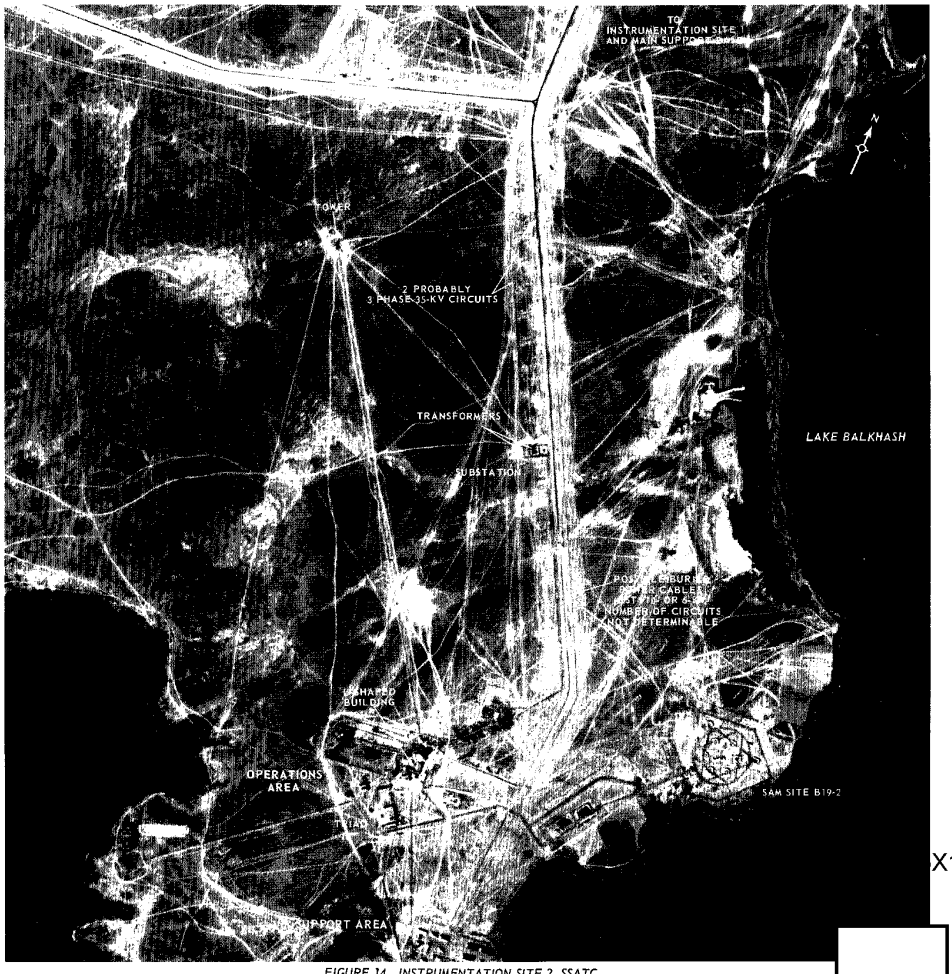

FIGURE 14. INSTRUMENTATION SITE 2, SSATC.

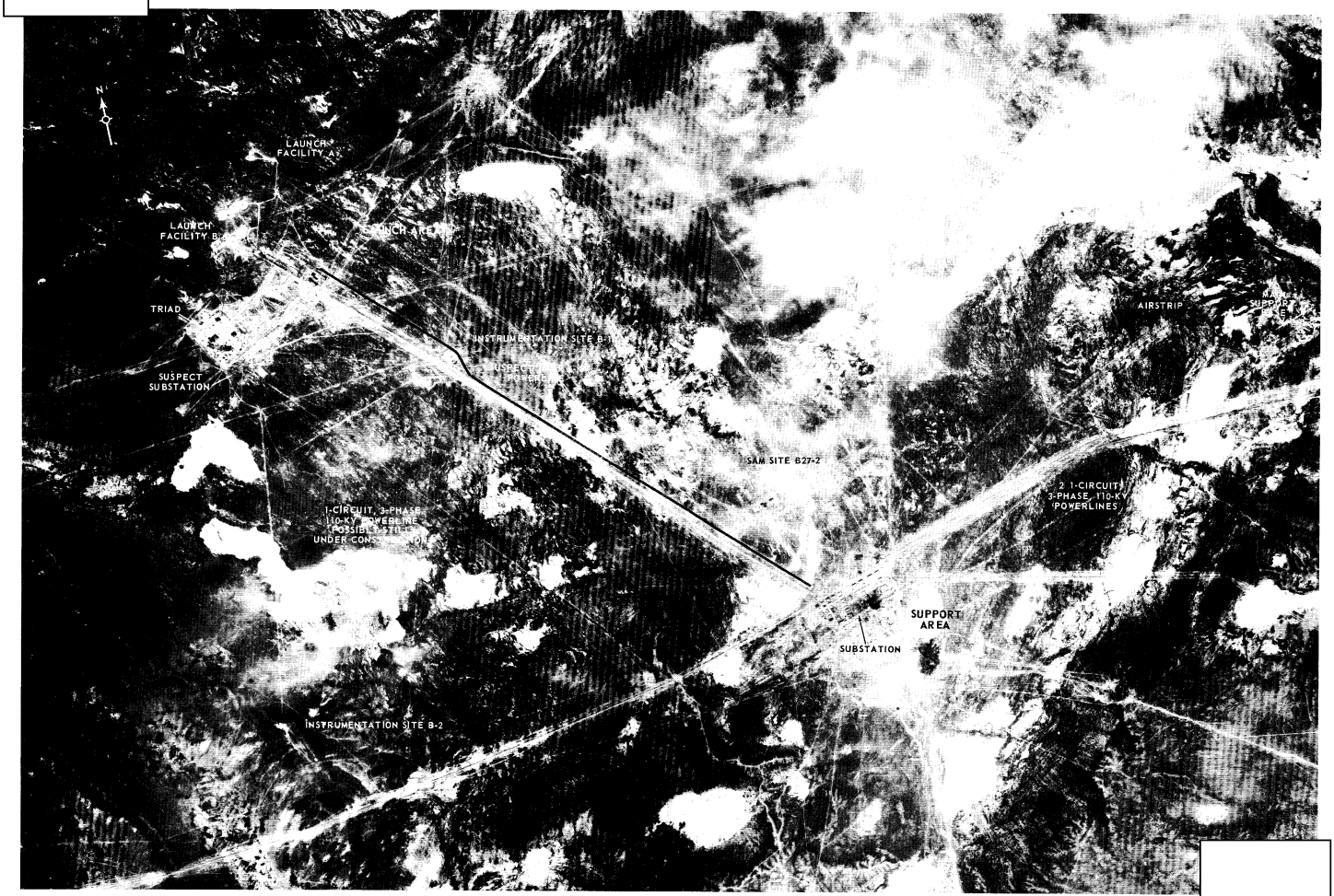

FIGURE 15. LAUNCH COMPLEX B.

of construction. The first powerline appears to have been that tying the substation at [redacted] The second, more direct, powerline probably was that tying the major Olenegorsk switching and transformer substation also to Alluaiv. During the early construction phases of the dual HEN HOUSE, this second powerline was cut, and sometime after [redacted] both portions were tied into the on-site substation by short taplines that crossed the first powerline. Later, more power was tied into the on-site substation by the addition of a third powerline directly from the Olenegorsk substation. This new powerline required 2 additional crossings of the earlier powerlines.

Electrical equipment had not been fully installed at the on-site substation in [redacted] Equipment for 6 switching positions was probably in place, and one of probably 2 transformers planned had been installed. The size of this transformer indicates that it probably has a capacity ranging between 10 and 20 MVA.

ANGARSK DUAL HEN HOUSES

The Angarsk installation at 52-53N 103-15E, which had 4 dual HEN HOUSEs under construction in [redacted] is served by the Siberian portion of the Soviet Unified Power System. Excellent photography of [redacted] has permitted the identification and plotting of all powerlines of 500-, 220-, and 110-kv, and some of 35-kv, in the vicinity of the installation.

A secured transformer substation in the support area of the installation will eventually receive power over 2 incoming 2-circuit 3-phase 110-kv powerlines. Two circuits may be, and the other 2 will be, tied into the local 110-kv power grid that follows the Angara River valley between Irkutsk and Cheremkhovo. The 1965 photography reveals only 3 circuits southeast of Cheremkhovo Substation. A fourth may possibly be added in the future (circuit diagram, Figure 27).

It is estimated that when the construction activities observed to be underway in [redacted] have been completed, the installation will be able to draw power not only from the southeast (the Angarsk-Irkutsk area) but also from the northwest (the Bratsk area). Power from the Bratsk area will come via a newly identified major switching and transformer substation at 53-05N 103-04E, southwest of Cheremkhovo. A second powerline southeast from this new substation was incomplete in [redacted] although many of the timber pi-portal supports were in place for it by [redacted] The incoming powerline from the direction of Angarsk apparently was completed before [redacted] When the 4 dual HEN HOUSEs are activated, the duodirectional power feed will provide security against complete power failure in the event of an outage of one circuit.

On [redacted] photography two transformers can be identified at the on-site substation, and available space for a possible third transformer is evident. The northernmost is estimated to have a capacity of 20 to 31.5 MVA and the other may have a capacity of 45 to 60 MVA. Calculations are based on lengths of 20 and 25 feet respectively, plus or minus 5 feet. Exact mensuration is obviated by obliquity and dark shadows.

It must be noted that any power transmitted through the single-circuit 220-kv powerline and the two parallel 500-kv single-circuit powerlines is available only indirectly. Bratsk-generated power from the 220-kv powerline is transmitted through the Cheremkhovo substation, and power from the 500-kv powerlines would have to be transmitted through Substation B at the Angarsk Atomic Energy Complex and the Cheremkhovo Substation. One 500-kv powerline was not yet tied into Substation B in spring, 1965, and probably was not transmitting any power.

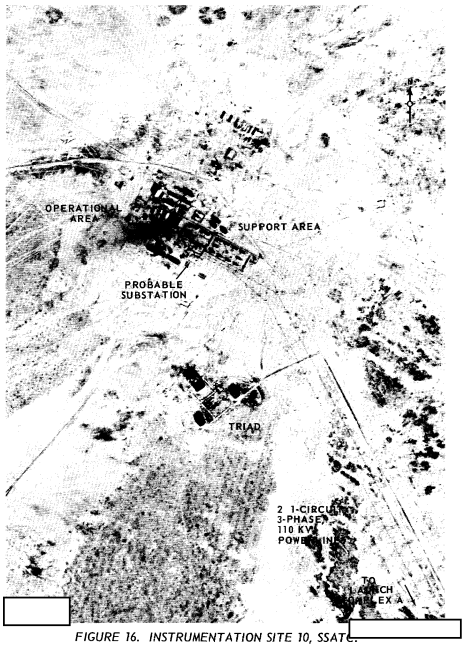

FIGURE 16. INSTRUMENTATION SITE 10, SSAT[redacted]

FIGURE 17. SITE 13, SSATC.

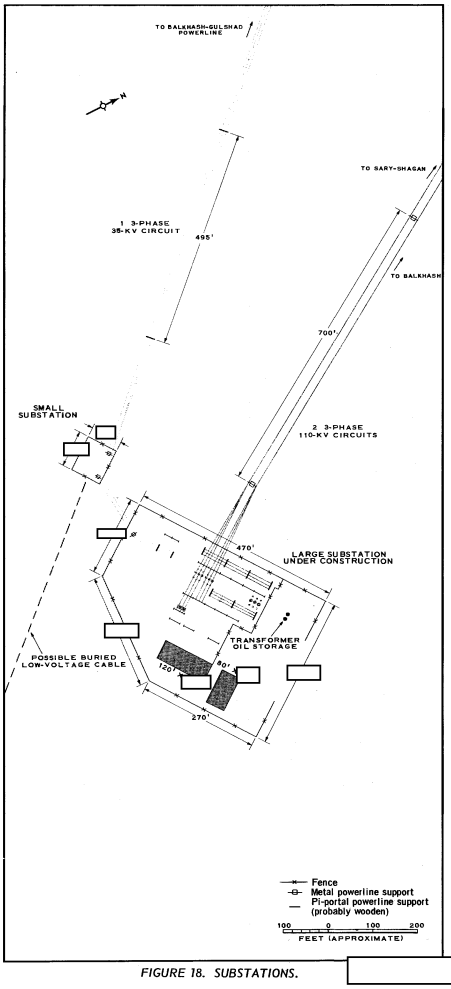

FIGURE 18. SUBSTATIONS.

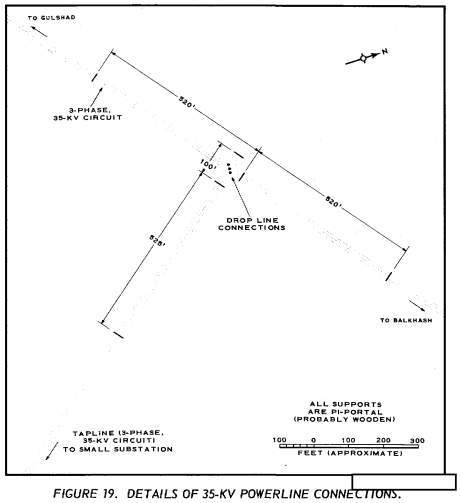

FIGURE 19. DETAILS OF 35-KV POWERLINE CONNECTIONS.

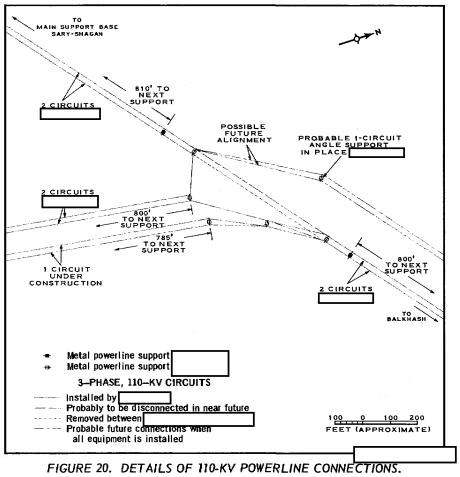

FIGURE 20. DETAILS OF 110-KV POWERLINE CONNECTIONS.

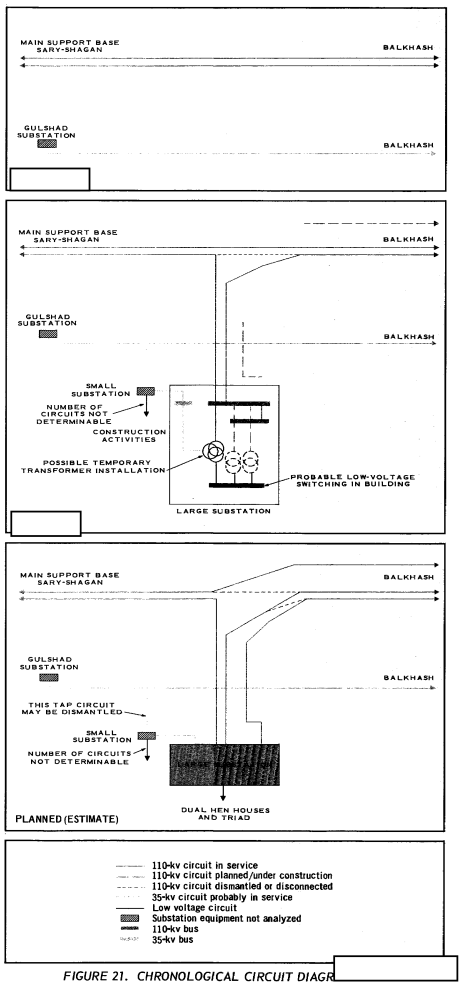

FIGURE 21. CHRONOLOGICAL CIRCUIT DIAGR

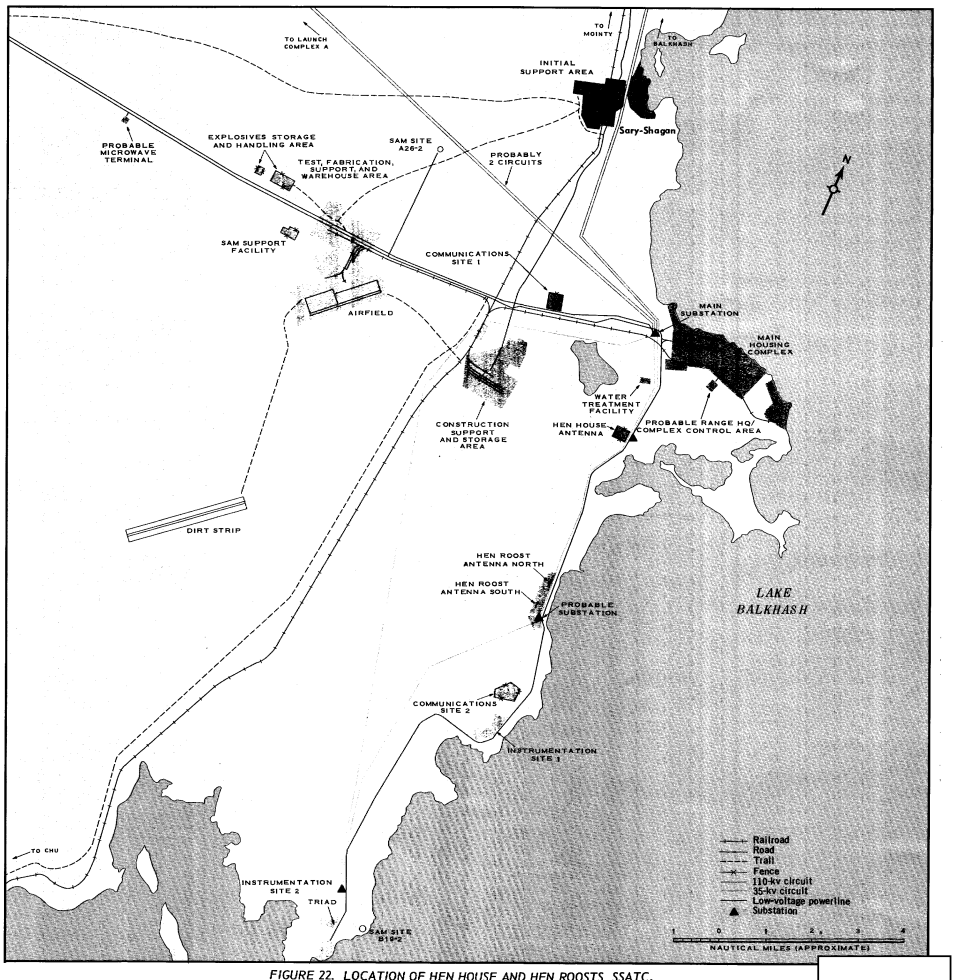

FIGURE 22. LOCATION OF HEN HOUSE AND HEN ROOSTS, SSATC.

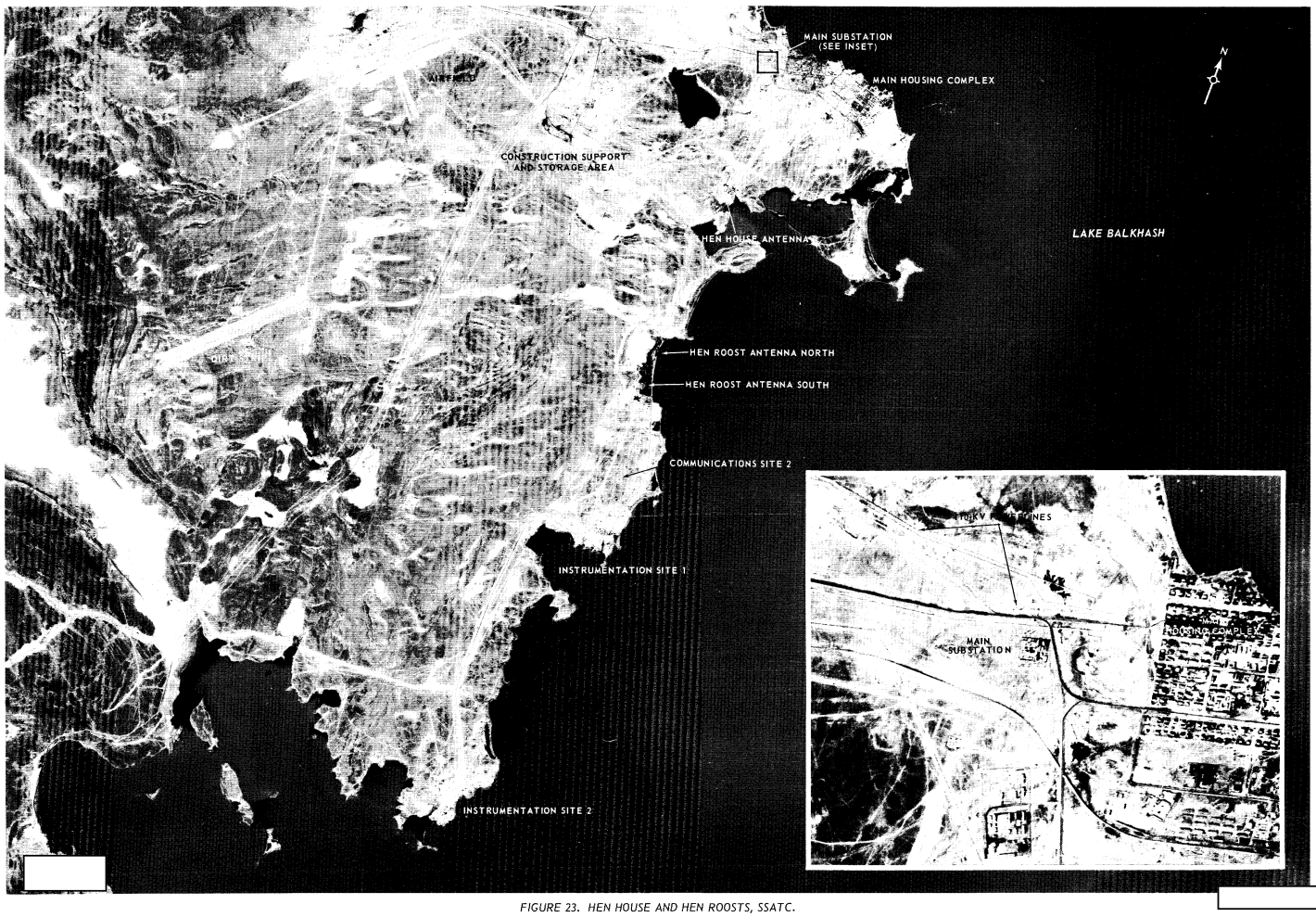

FIGURE 23. HEN HOUSE AND HEN ROOSTS, SSATC.

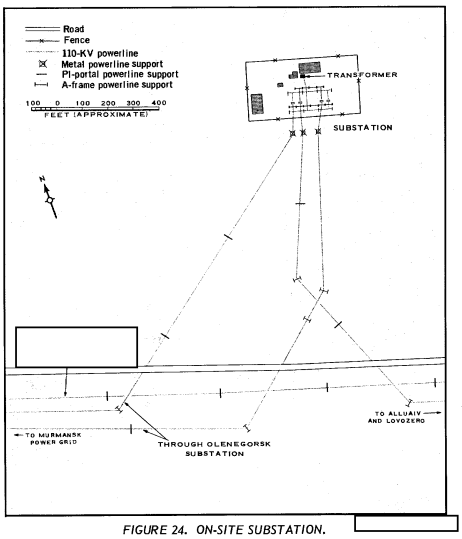

FIGURE 24. ON-SITE SUBSTATION.

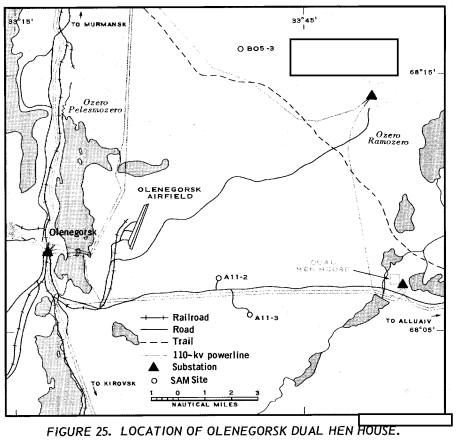

FIGURE 25. LOCATION OF OLENEGORSK DUAL HEN HOUSE.

FIGURE 26. OLENEGORSK DUAL HEN HOUSE.

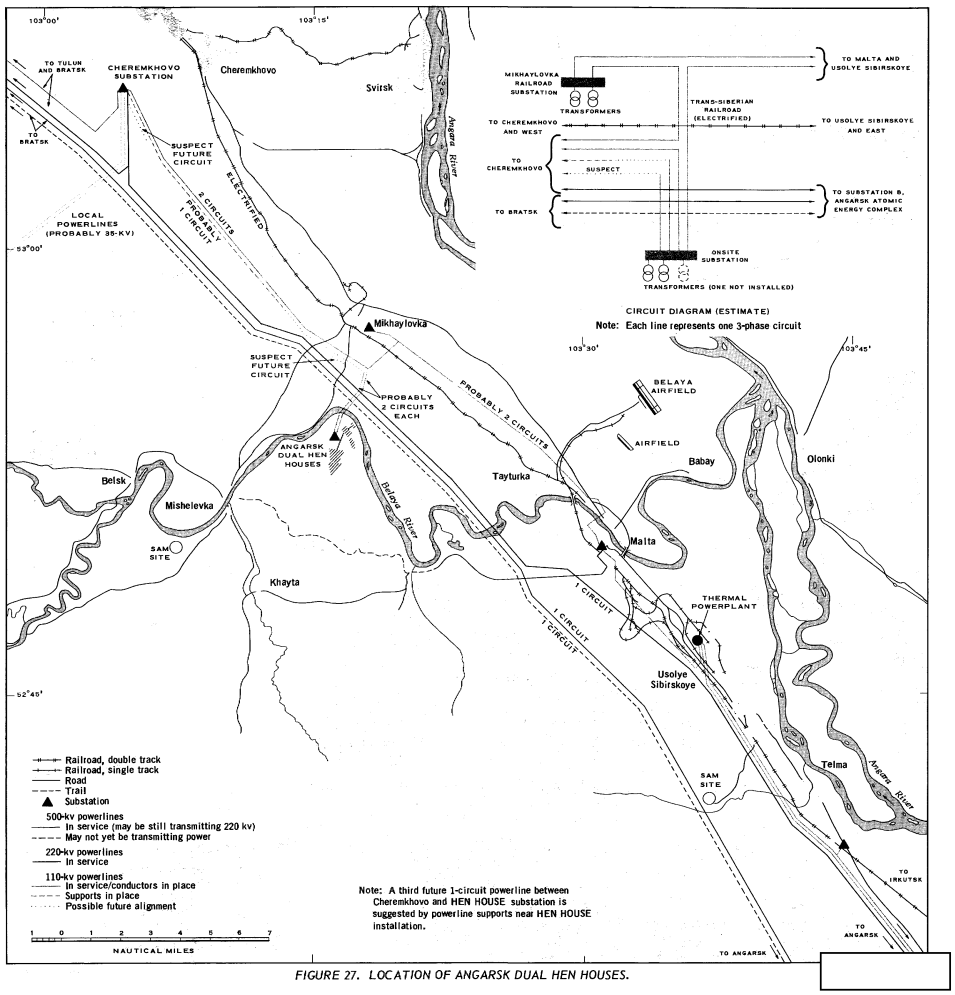

FIGURE 27. LOCATION OF ANGARSK DUAL HEN HOUSES.

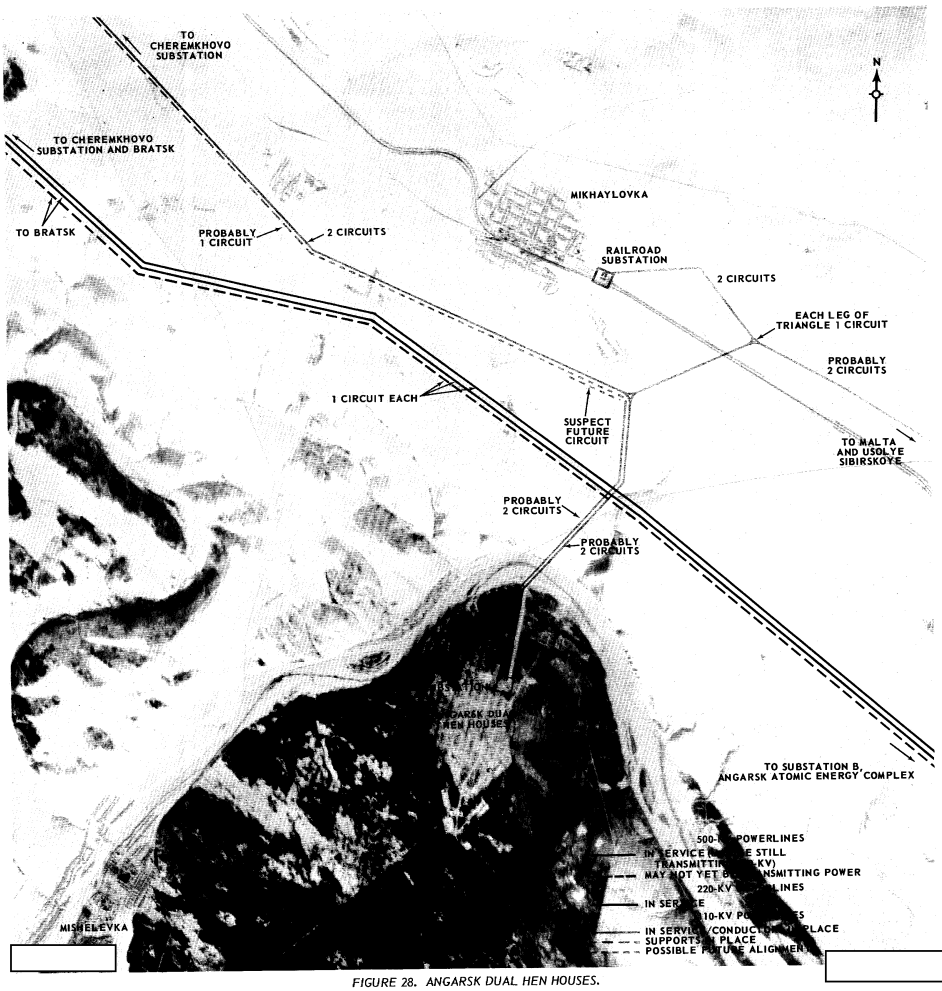

FIGURE 28. ANGARSK DUAL HEN HOUSES.

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